# First Record of *Okenia impexa* Marcus, 1957 from the Western Atlantic in the Mediterranean

BY

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(1 Plate; 2 Text figures)

## INTRODUCTION

During a study of the Nudibranchia of the western Mediterranean, we collected 2 rare species at Naples and at Banyuls: *Okenia mediterranea* (von Ihering, 1886), which has not been mentioned since Ihering, and *O. impexa* Marcus, 1957, from São Paulo and North Carolina. Because there are some consistent differences between the Mediterranean and the western Atlantic material, the anatomy of the Mediterranean *O. impexa* is described here. We hope that on the basis of this description further research in the western Atlantic will help to decide whether the species has entered recently into the Mediterranean or whether it is a geographical subspecies.

### Goniodorididae

Eudoridacea suctoria, phanerobranchiate, rhinophores laminated without sheaths. There is a narrow pallial ridge on the head and on the sides, with or without simple appendages – or the pallial ridge is reduced and there are only appendages. Radula without median tooth, often with 2 lateral teeth, the inner one hook-shaped and larger than the often plate-shaped marginal tooth. Labial cuticle smooth or armed with hooklets or plates.

### *Okenia* Menke, 1830

Body with a narrow pallial ridge with simple appendages. The anterior border of the notum is developed as a narrow, sometimes bilobed frontal velum. Rhinophores often laminated only behind. Gills often unipinnate. Radula formula 1·1·0·1·1. First lateral tooth large and hook-shaped with a smooth or denticulated inner border. Outer lateral tooth small, plate-shaped with 1, 2 or 3 cusps. Labial cuticle smooth or armed with hooklets or plates. Penis armed with cuticular spines.

*Okenia* Menke, 1830 (on official list no. 1995, Bull. Zool. Nomencl. 1974: 13). Type species: *Idalia elegans* Leuckart, 1828 (Figure 2). Menke, Synopsis methodica molluscorum generum omnium 1830: 10. For discussion see: Bergh, 1881: 144; 1907; Burn, 1971: 151; Lemche, 1971: 262 - 266; Marcus, 1957: 434 ff.; Marcus & Marcus, 1967: 203.

I agree with Marcus (1957: 436) and Burn (1971: 151), that the division made by Bergh (1881: 144) into the subgenera *Okenia s. str.* (Bergh: *Idalia s. str.*) (with appendages in the middle of the back) and *Idaliella* (without such appendages) is not natural.

### *Okenia impexa* Marcus, 1957

(Figures 1a, 1b, 4, 5)

**Material:** Banyuls: 5 specimens, alive, 3 - 4 mm length, 1 - 20 September 1976; on *Halimeda* and Corallinaceae, 15 m near Cap Oullestreil and 5 m near Collioure. Naples: 2 specimens, 3 - 4 mm length, 11 March 1977, 7 m, sand.

**Description:** Description of an undamaged animal found on *Halimeda* in 12 - 15 m depth in front of Cap Oullestreil, 14 September 1976. The genital organs and the radula of a 2nd specimen of the same length are described.

Alive and extended, the body is 4 mm long with a maximum height and width of 0.8 mm. The notum is not broader than the foot and is bordered frontally and laterally by a distinct pallial ridge. Caudally the notum merges without pallial ridge into the 1.5 mm long tail. Around the head, the pallial ridge bears 6 digitiform, apically pointed, rather stiff appendages (another specimen has only 4, a 3rd one, 5 appendages), the 4 anteriormost of which are about 1 mm long, and longer than both lateral ones. Behind the rhinophores the pallial ridge has 5 cerata on each side, the last 2 are united at their bases. From cephal to caudal, these lateral cerata increase to a length of 0.8 mm. They have a characteristic shape, swell-

ed and rounded at the tip, but extremely narrowed at the base. Halfway between the rhinophores and gills a low longitudinal median cresta begins, which ends at the gills. It bears one short, finger-shaped, pointed tubercle in front of the gills. The rest of the notum is smooth without any tubercles. The 0.8 mm wide foot possesses short, 0.1 mm long, protruding and pointed front angles and is pointed behind. The smooth anterior border of the foot is neither horizontally grooved nor medianly notched.

The head is covered by a small bilobed veil, only slightly set off from the head on the sides.

Extended, the rhinophores have a length of 1.2 mm with a maximum diameter of 0.2 mm. They are smooth in front and laminated with 10 leaflets behind only, from the tip almost to the base.

Four simple pinnate gills, which have a maximum length of 0.8 mm, insert tightly around the anus, which is situated 2.2 mm from the anterior border of the body.

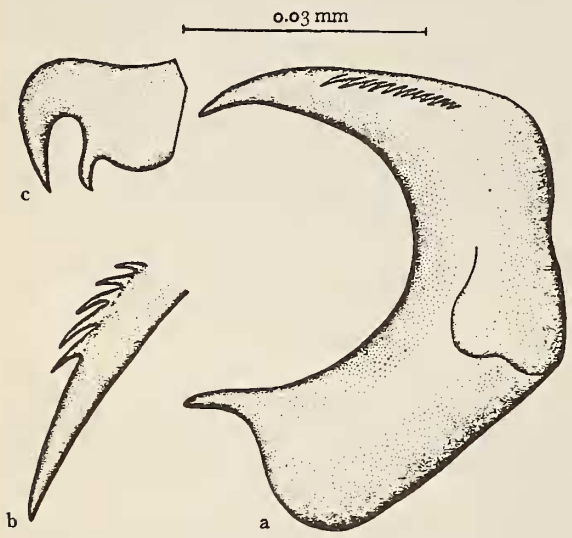


Figure 4

*Okenia impexa*

Radula: (a) 1st lateral tooth – (b) denticulated inner border of the 1st lateral tooth – (c) marginal tooth

The genital openings are situated somewhat behind the rhinophores and closely below the right pallial ridge.

The labial armature consists of a thin cuticular ring without recognizable papillae.

The radular formula (Figure 4) of an animal of 4 mm is 15 × 1 · 1 · 0 · 1 · 1. The radula rhachis shows no cuticular support. The 1st lateral tooth is strongly hook-shaped and twice as long as the plate-shaped marginal tooth. Basis (0.06 mm) and tip (0.05 mm) of the 1st lateral tooth stand in a more or less straight angle towards one another. Its tip bears on the inner border about 10 pointed denticles, which decrease from the tip towards the basis. The marginal tooth is 0.027 mm high and 0.018 mm wide. It possesses a sharp cusp and its edge has one hook-shaped denticle.

The specimens of 3 and 4 mm body-length copulated. Nevertheless, no egg masses could be observed. One day after copulation, the genital organs of a 4 mm long animal were studied (Figure 5). The hermaphrodite duct enters into a wide ellipsoid ampulla. The postampullar hermaphrodite duct is enclosed by the well-developed, swollen female gland mass in such a way that its proper course can not be pursued. Immediately behind the bifurcation of the spermoviduct, the vas deferens increases to a long, big prostatic tube, which encloses the ampulla. The prostate occupies about $\frac{2}{3}$ of the length of the vas deferens. It continues into a short ductus ejaculatorius, which ends in a penis, armed with pointed cuticular spines. The sheath of the penis closely encloses the penis. Between the sheath of the penis and the vagina a gland is situated, which appears white, compact and grape-like after fixation. The vagina is a straight duct, which runs beside the penis into a common vestibulum. At the wide vaginal duct a spherical bursa and an ellipsoid receptaculum insert close to one another. Both vesicles appear to have a short stalk. Nevertheless, their mode of insertion could not be clearly established because of their tight filling.

The general body colour is a bright transparent whitish yellow. The rhinophores, the gills and the cerata as well as the pallial ridge and the median cresta show, almost uniformly, this transparent yellow. On the notum and the sides of the foot there is a dense, fine brown (in

## Explanation of Figures 1 to 3

Figures 1a, 1b: *Okenia impexa* Marcus, 1957 4 mm
Figure 2: *Okenia elegans* (Leuckart, 1828) (Banyuls) 5 mm
Figures 3a, 3b, 3c: *Okenia mediterranea* (von Ihering, 1886) 4 mm

Figure 1a

Figure 1b

Figure 2

Figure 3a

Figure 3b

Figure 3c

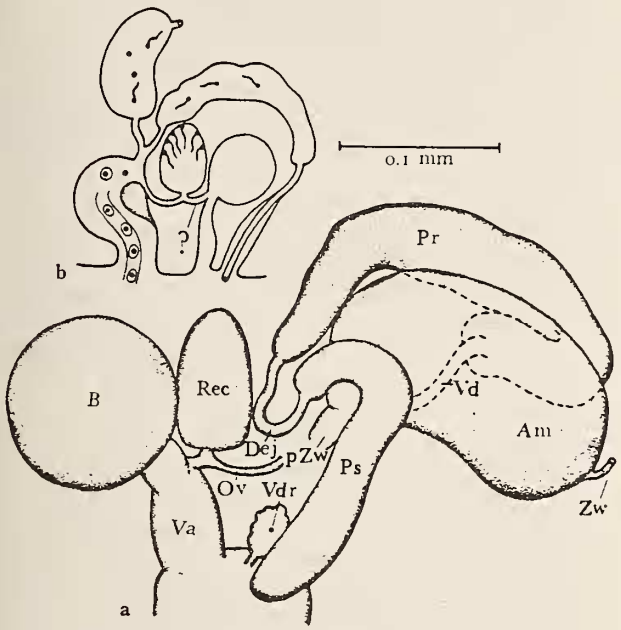


**Figure 5**

*Okenia impexa*

Reproductive system: (a) anatomy – (b) schematic
Am – ampulla B – bursa D. ej. – ductus ejaculatorius
Ov – oviduct Pr – prostate Rec – receptaculum seminis
Va – vagina Vdr – vestibulum gland

artificial light red-brown) punctation, which is the most distinct on head and back, the most weak on velum and tail. The sides of the body show an average brown pigmentation. Moreover, some few brown dots are situated basally on rhinophores, gills and cerata. All opaque white pattern is lacking. The eyes and spiculae may be observed through the epithelium.

## DISCUSSION

Marcus (1957) published a list of 15 known species of *Okenia,* and 2 new ones, thus altogether 17 species. Since then, the following species - as far as I know - have been described:

*Okenia opuntia* Baba, 1960: 80; Japan
*Okenia plana* Baba, 1960: 80; Japan
*Okenia babai* Hamatani, 1961: 117; Japan
*Okenia angelensis* Lance, 1966: 76; north-eastern Pacific
*Okenia mija* Burn, 1967: 55; south-eastern Australia
*Okenia sapelona* Marcus & Marcus, 1967: 203; south-eastern coast of the United States
*Okenia cupella* (Vogel & Schultz, 1970: 390; eastern coast of the United States) (*Cargoa* Vogel & Schultz, 1970 is a later subjective synonym of *Okenia*; cf. Burn, 1971 and Opinion 1014, Bull. Zool. Nomencl. 1974)
*Okenia ascidicola* Morse, 1972: 92; Massachusetts

The external appearance of *Okenia impexa* Marcus, 1957 differs clearly from most of the above mentioned species because of its peculiar cerata, which are swollen and rounded at the tip, narrow at the base, and also because it possesses a single median tubercle on the back. Comparably shaped cerata and 1 median appendage are possessed – among the above mentioned 25 species – only by *O. plebeia* Bergh, 1902 with a rounded lateral tooth and plate-shaped elements on the labial cuticle (Bergh, 1902: plt. III, fig. 17) and *O. impexa* Marcus, 1957. After the examination of the Mediterranean specimen, Dr. Eveline du Bois-Reymond Marcus confirmed that our animals are *O. impexa* Marcus, 1957. The shape of the radula, the labial armature and the genital complex correspond in the main features in the animals from the western and from the eastern Atlantic. But there are some differences in the internal anatomy, *e. g.*, in the shape of the lateral tooth, which has 2 cusps in the Mediterranean (Figure 4c), 3 cusps in the western Atlantic specimens. The external habitus also shows differences. In the western Atlantic specimens the median ceras of the notum is club-shaped and is of the same length as the appendages of the notum border. All the specimens from Naples and Banyuls however, have a very short, pointed, finger-shaped tubercle (Figure 1b). The lateral posterior appendages of the notum border are apically swollen and rounded in the Mediterranean animals (Figures 1a, 1b), "claviform though pointed" (Marcus, 1957: 434) in the western Atlantic specimens. Because we only know very little about the variability of the species in the western Atlantic (Marcus, 1957, 1961) and in the Mediterranean, we cannot decide whether the mentioned differences are within the normal range of variability of the species or whether they are a manifestation of an independent development in the western and eastern Atlantic and, thus, whether or not the 2 forms represent 2 geographical subspecies. If further observations in the western Atlantic confirm the constancy of the above mentioned geographical differences, I name the eastern Atlantic subspecies *Okenia impexa banyulensis.* But as the species was not

found in Naples or Banyuls prior to 1976, it may be possible that *Okenia impexa* has only recently entered into the Mediterranean, similarly as, presumably, *Doto doerga* Marcus & Marcus, 1963 (Schmekel, 1958).

Should further research establish that this is indeed a new subspecies, I select the specimen described as the holotype (Figures *1a*, *1b*) and the dissected specimen as paratype. The holotype has been deposited in the collection of the Naturhistorisches Museum in Basel, Switzerland; the dissected material in the form of microscope slides is on deposit at Münster, Germany.

*Okenia mediterranea* (von Ihering, 1886)

(Figures *3a*, *3b*, *3c*)

**Material:** Naples: 3 specimens, alive, 3 - 5 mm long, from *Posidonia* and other dredged material. Canale di Procida, 20 m, 19 August 1963; Bocca piccola, 75 m, 12 November 1964; Banco Capo Miseno, 30 m, 23 March 1967.

**Description:** Description of a live 4.5 mm long animal, found 19 August 1963 on *Posidonia,* Canale di Procida, 20 m.

Without measuring the cerata, the flat body (Figure *3*) has a length of 4 mm after fixation. The notum has – also without the cerata – its maximum width of 1.6 mm immediately behind the rhinophores. The maximum height of 1.2 mm is found in the region of the pericard in front of the gills. The notum is broader than the foot and is anteriorly and laterally bordered by an approximately 0.5 mm broad free notum margin. Caudally the notum merges without pallial ridge into the weakly keeled tail, measuring about $\frac{1}{6}$ of the body length. The free notum border bears finger-shaped pointed appendages. On each side are situated 8 cerata, the last 2 of which are united at their base. One unpaired ceras is situated medianly behind the gills. The longest, 1 mm long cerata insert in the middle of the anterior pallial ridge; caudally the appendages become continually shorter. In the median line of the notum a low keel-shaped cresta runs from the rhinophores towards the gills. It shows 5 small elevations, but it does not bear tubercles. The rest of the notum is smooth. The smooth anterior border of the foot possesses rounded front angles. Frontally the foot has its maximum width of nearly 1 mm, which decreases continuously towards the tip of the tail.

A bilobed veil is situated over the mouth and underneath the notum border. This veil has large rounded lobes of 1.2 × 0.4 mm (Figure *3b*) and a median emargination.

The very slender, 1.2 mm long rhinophores are situated 0.4 mm from the anterior border of the notum. They are smooth in front and laminated with about 23 fine lamellae only behind, from the tip almost to the base.

Five slender, unipinnate gills, which have a maximum length of 1 mm, are situated medianly at the beginning of last body-third. They insert on a wide, open half-circle in front of the anus.

The genital openings are situated at the end of the 1st body-third closely below the right notum ridge.

The labial armature consists of a cuticle ring, which is bordered by closely set, low, denticulated papillae on $\frac{8}{9}$ of its circumference.

The radular formula of a 5 mm long live animal is 18 × 1 · 1 · 0 · 1 · 1. The radular rhachis bears no teeth and shows no cuticular support. The 1st lateral tooth is hook-shaped and twice as long as the plate-shaped marginal tooth. Basis (0.075 mm) and tip (0.06 mm) of the 1st lateral tooth have about the same length and stand in a more or less straight angle towards one another. On the inner border the tip possesses pointed denticles. The marginal tooth with a diameter of 0.03 mm shows a roundish shape with 1 very small hook-shaped cusp.

The animal, found 11 December 1964 with a body length of 5 mm while living, was mature, but the preservation of the anterior genital complex does not permit a precise reconstruction. The situs corresponds in the main features with the situs of *Okenia amoenula* Bergh, 1907 (Magnae, 1952: fig. 23). There is a well-developed female gland mass, an ampulla, which is tightly filled with sperms and a big, spherical bursa copulatrix. The vas deferens increases to a long prostate tube, which distally decreases into a narrow ductus ejaculatorius, which continues into a tube-shaped penis.

The general body colour is whitish, though some regions of the notum appear yellowish or reddish because of the intestine underneath. The right lobe of the veil, but not the left one, shows at its end a big bright yellow spot. A similar spot covers the tip of the tail. All cerata are yellow from the tip almost to the base, sprinkled with fine clear cadmium-red. The same combination of yellow and clear cadmium-red – which may combine to orange – is to be found on the distal half of the gills and on the median cresta. Dorsally on the right and left side of the notum run 2 irregular stripes of roundish, sometimes very gradually elevated cadmium-red spots towards the tail. Dark cadmium-red spots are also to be observed in the furrow between foot and mantle. The rhinophores are completely opaque-white.

**Colour and shape variations:** An animal of 4.5 mm body length when alive, found 12 November 1974, pos-